U.S. EPA Local Climate & Energy Webcast
Energy Efficiency in Water and Wastewater Facilities

October 30, 2013

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www.mass.gov/dep

MassDEP
Commonwealth of Massachusetts
Department of Environmental Protection

Water / Wastewater Treatment in MA

- 370 public facilities
- $150M / year

Impacts

- 1 billion kWhs
- 1 million tons (CO_2)

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A New Public / Private Partnership

Public

- (7) Water & (7) Wastewater Facilities
- MA Dept. of Environmental Protection
- MA Executive Office of Energy / Environmental Affairs
- MA Dept of Energy Resources
- EPA New England
- MA Renewable Energy Trust
- University of MA – Northeast CHP Center

Private

- Every Major Investor-Owned Electric & Gas Utility

Non Profit

- Consortium for Energy Efficiency

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Massachusetts' Energy Pilot

(2007 – 2010)

- Advance energy efficiency
- Advance clean energy
- A working model

Goal: 20% reduction in costs & CO_2 emissions

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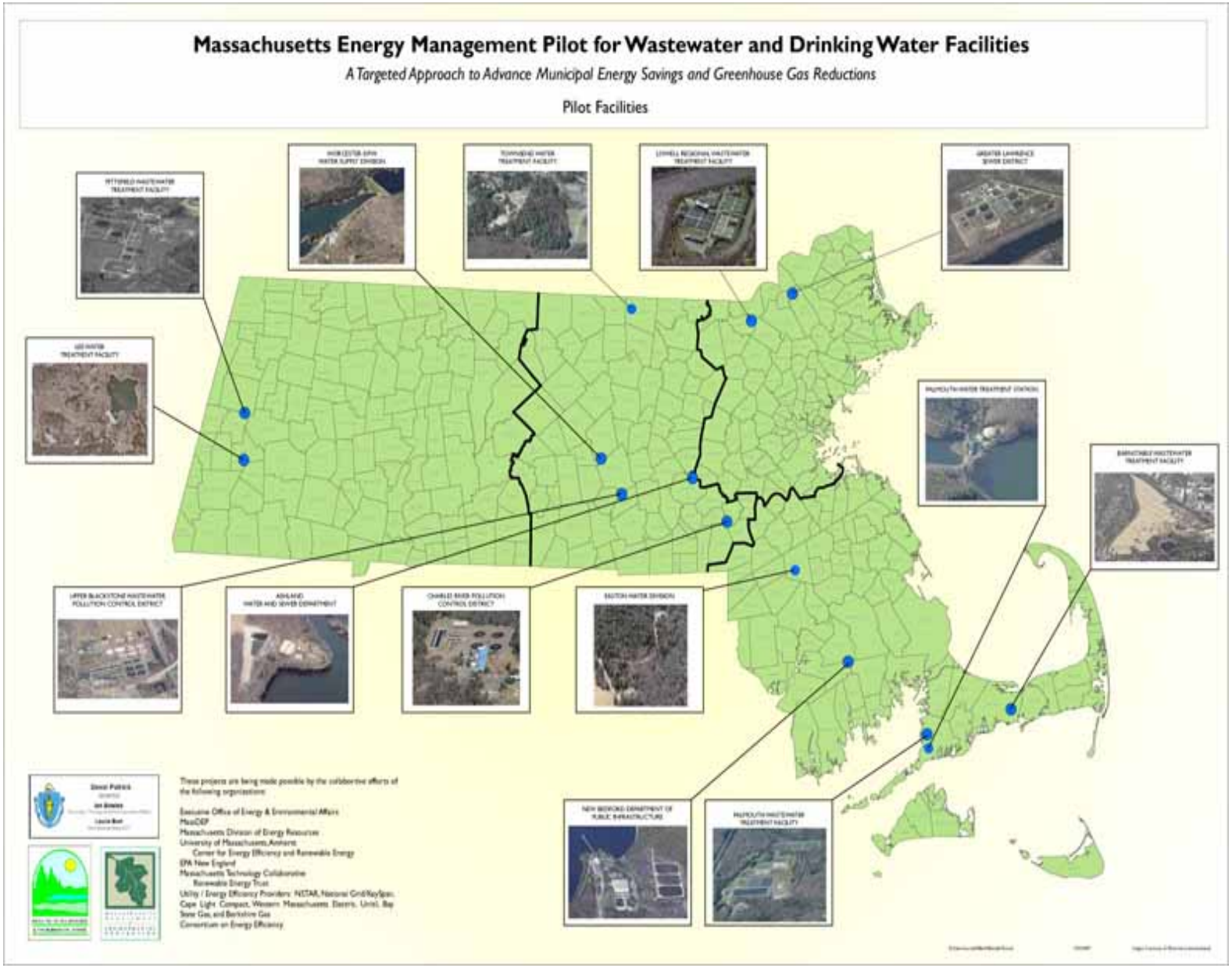

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14 Pilot Facilities

Efficiency: **Save $2M / Year**

Green Power: **Save $1.7M / Year**

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ARRA – Green Infrastructure

Recovery & Reinvestment:

Clean Energy & the Environment

Jump-start "Green" projects: 20% of SRF ARRA

Fully Implement Energy Pilot & Other "Green" projects

(7) Wastewater Plants:	**$42.6M**
(7) Water Plants:	**$ 8.2M**
	$50.8M
(7) Others	**$17.8M**
Total	**$68.6M**

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CITY OF PITTSFIELD
WASTEWATER TREATMENT PLANT UPGRADES
FUNDED THROUGH MASSACHUSETTS DEP'S
CLEAN WATER STATE REVOLVING FUND (CWSRF) PROGRAM &
AMERICAN RECOVERY AND REINVESTMENT ACT (ARRA)
BAR RACK REPLACEMENT
$1,860,000
CONTRACTOR: R.H. WHITE
AUBURN, MA
AERATION UPGRADES
$2,371,863
CONTRACTOR: C.H. NICKERSON
TORRINGTON, CT
COMBINED HEAT & POWER
$1,919,000
CONTRACTOR: R H. WHITE
AUBURN, MA
PHOTOVOLTAIC INSTALLATION
$7,324,682
CONTRACTOR: NEXAMP
NORTH ANDOVER, MA
KLEINFELDER
S E A
ENGINEER: KLEINFELDER/S E A
ROCKY HILL, CT

Results

- Save $5+M / year for ratepayers
- 34% annual reduction in energy costs and CO_2 emissions
- 10+ megawatts of “green” power
  - 5.2 MW (solar), 4.8 MW (wind)
  - .34 MW (CHP), .20 MW (hydro)
- Zero-net energy pathway

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MA Energy Leaders

- Coalition of state, federal, community & energy efficiency providers (Mass Save®)
- Each meeting has a technical presentation, a presentation from a utility, a discussion on energy management planning, and a site visit.

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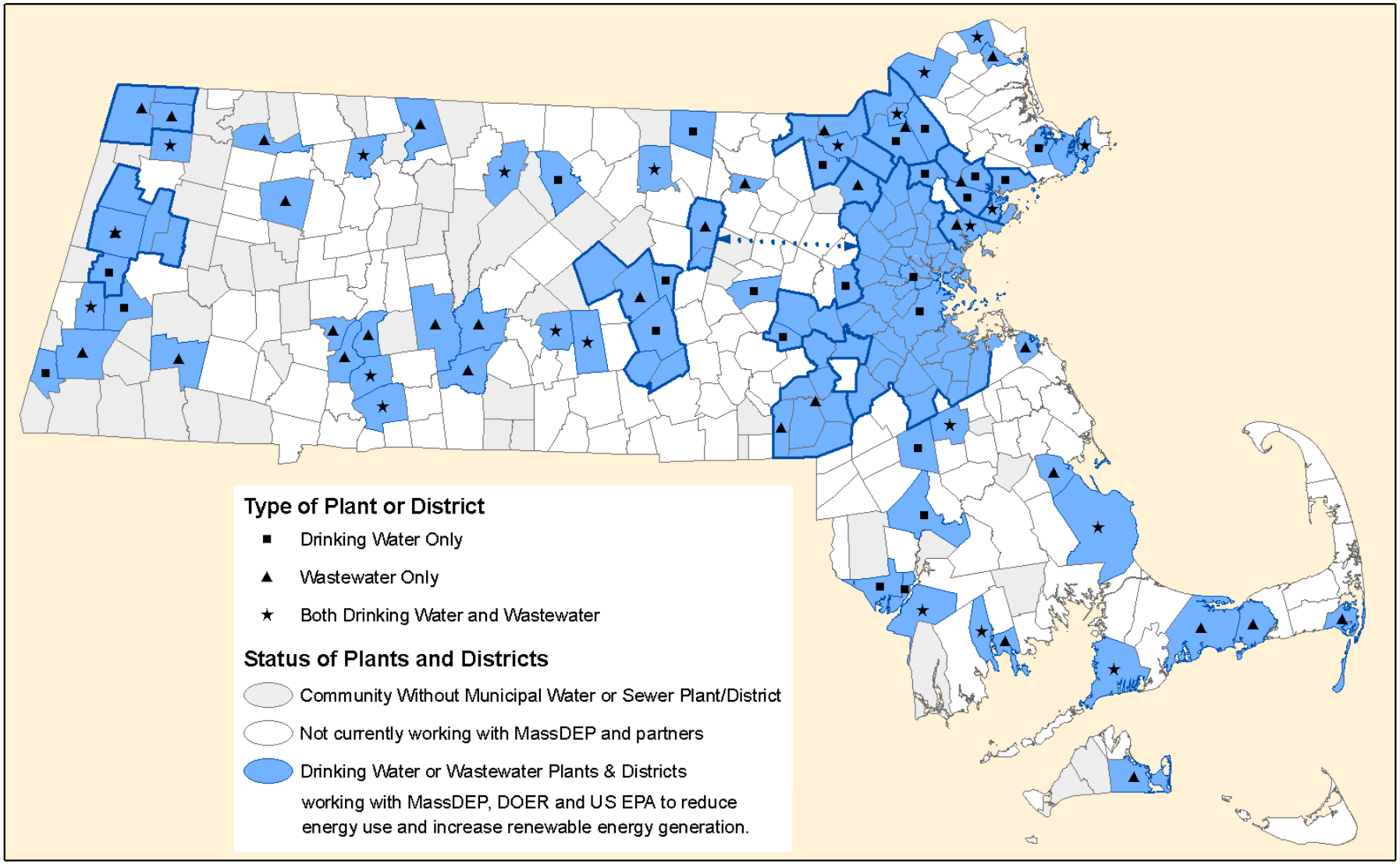
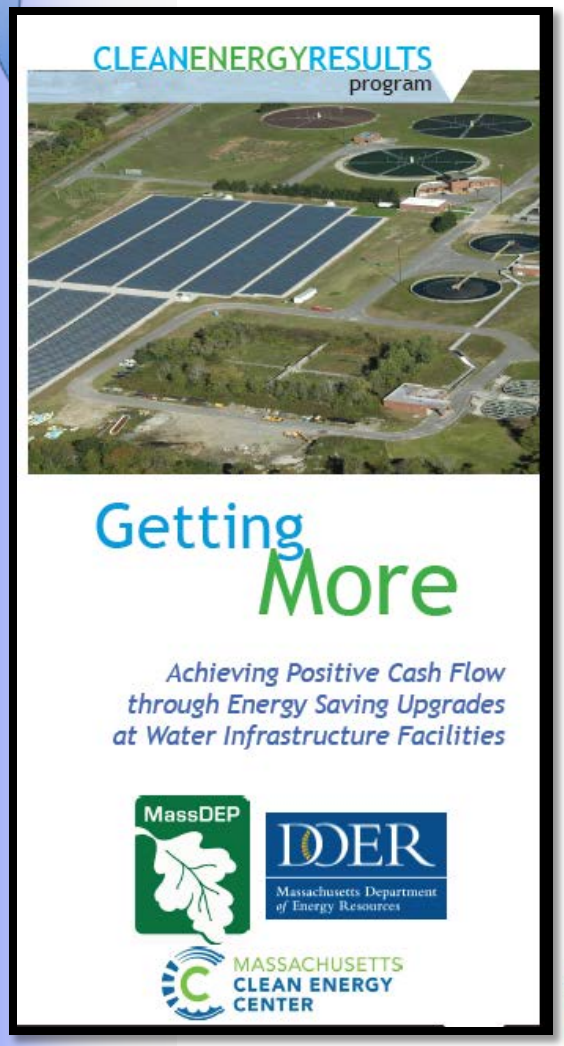
Drinking Water and Wastewater Plants and Districts Working with MassDEP, DOER, and U.S. EPA to Address Energy Use



0 4 8 16 Miles

Map provided by DOER
7-22-11, jpfister

Reducing Operating Costs & Reinvesting in your Facility



- *Quantify energy & cost savings*
- *Energy-savings can boost your bottom line & reduce your carbon footprint*
- *Pay for wasted energy or reinvest it in your facility (people / equipment / assets)*

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Thank You!

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GREATER LAWRENCE SANITARY DISTRICT ENERGY EFFICIENCY PROGRAM 2000-2013

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Presented by:

Richard E. Weare, GLSD Capital Projects Manager

GLSD WWTP SYSTEM

- MEMBER COMMUNITIES
  - Lawrence, Methuen, Andover, No. Andover, Dracut, MA & Salem, NH
- Wastewater Treatment Plant
  - Design Capacity - 52 MGD
  - “Wet Weather” Peak Flow Capacity - 135 MGD
  - Based on CSO LTCP increase wet weather pumping to 167 MGD
  - Peak Secondary Flow Capacity - 126 MGD
- Pumping Station
  - 2 - 800 h.p. Pumps and 2 – 1250 h.p. Pumps
- Sludge Drying Facility
  - 2 Process Trains rated at 19 dry tons/day each

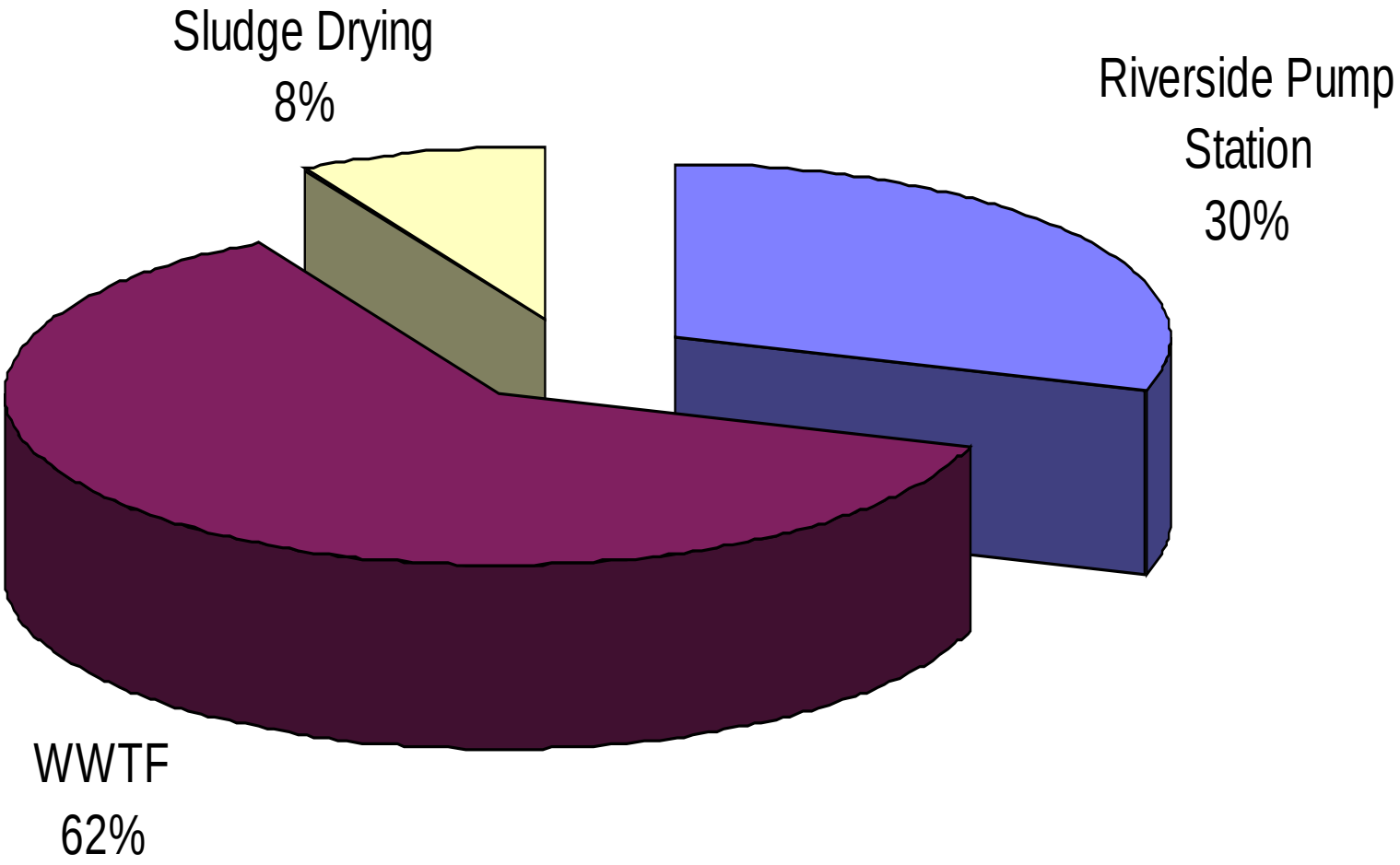
GLSD ENERGY EFFICIENCY STUDY PLANS

- Energy Evaluation Audit – 1995
  - No Action on 1995 Evaluation
- Biosolids Improvement Study - 1998
- Lighting System Evaluation – 2001
- Secondary Treatment System Evaluation – 2004
  - Replace Mechanical Aeration with Fine Bubble Diffusers and Anaerobic Selector – Completed in 2006
- Renewable Energy Assessment - 2008
- Comprehensive Energy Evaluation Audit – 2009
  - Participated in the DEP Energy Management Pilot Program
  - Phase 1 Construction Completed in 2010 with ARRA Stimulus Funds
- Lighting System Evaluation – 2009
- Primary and Secondary Energy Evaluation - 2012

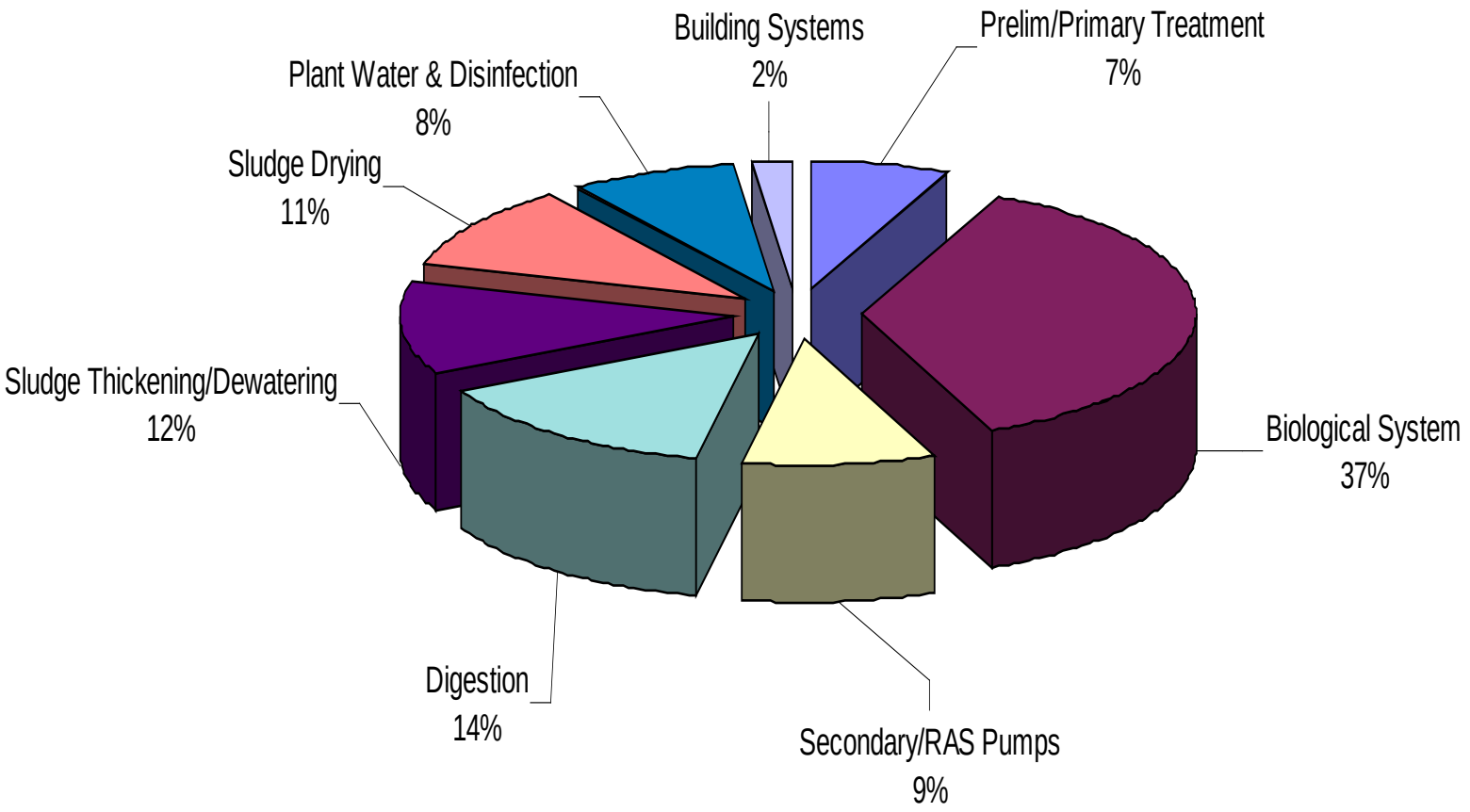
SCOPE OF 2009 ENERGY AUDIT

- A Comprehensive Energy Evaluation Audit was performed which provided specific energy improvement recommendations
- Identified Energy Use and Cost Components
- Cost Effective Energy Savings Recommendations:
  - GLSD Operational Measures
    - 5 Low Cost Operational Measures Identified
  - GLSD Energy Conservation Measures
    - 18 Conservation Measures Identified
  - GLSD Energy Supply Measures
    - 2 Supply Measures Identified
- GLSD uses the EPA Plan-Do-Check-Act system for its Energy Program

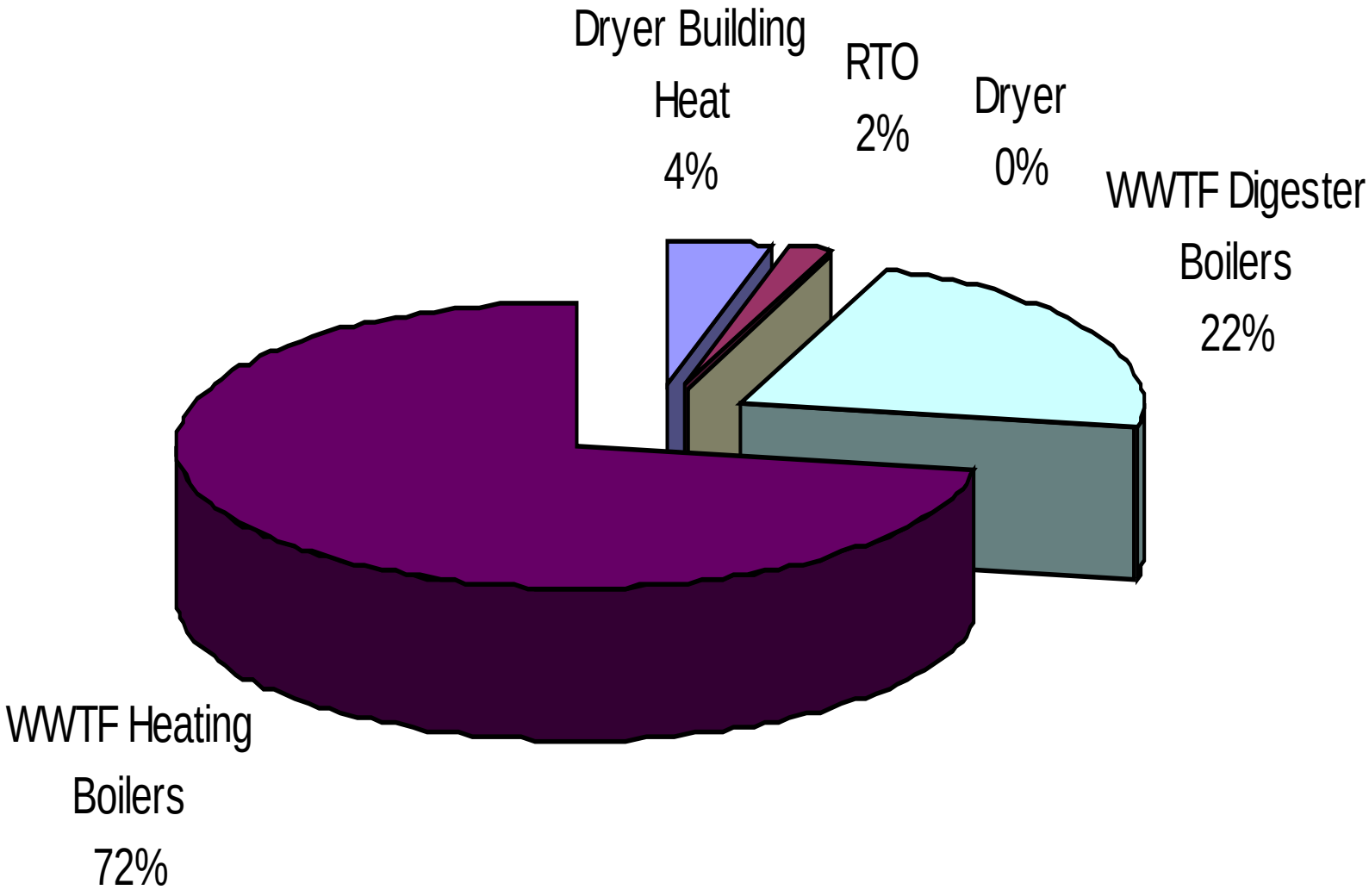
Electric Energy Use



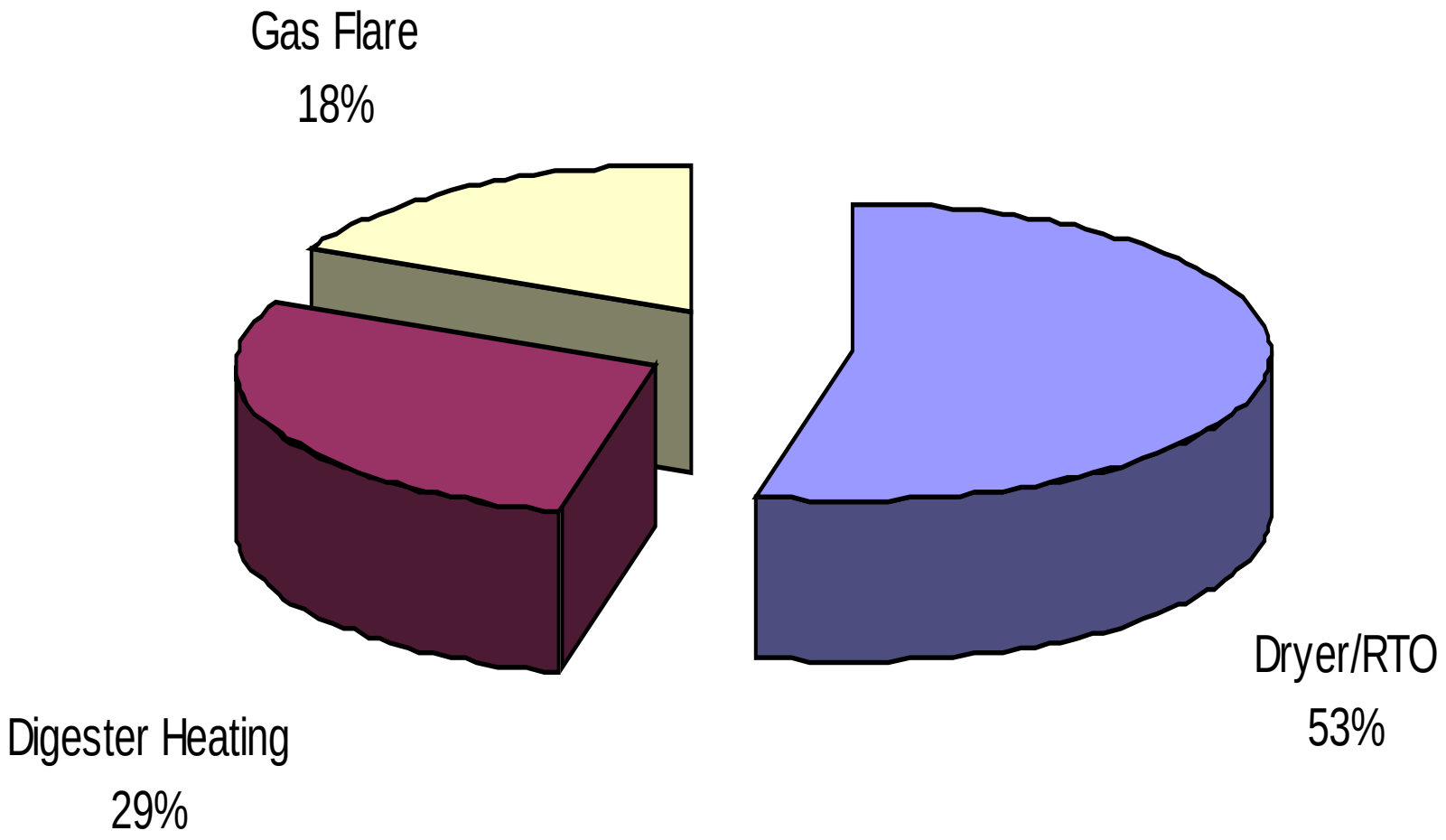
GLSD WWTF Electric Energy Breakdown



2007 GLSD Natural Gas Use



2007 Digester Gas Use



2009 ENERGY AUDIT STUDY
ESTIMATED SAVINGS

- **Electricity**
  - kWh Savings (1) : 4,537,062
  - kW Savings (2) : 550
  - Electric Cost Savings: $ 636,963
- **Natural Gas**
  - MMBtu Saved: 28,150
  - Natural Gas Savings (3): $ 349,624
- **Reduced Emissions**
  - Carbon Dioxide 2035 Tons
  - Methane 349 lbs.
  - Nitrous Oxides 73 lbs.

(1) Based on $0.1343/kWh;
(2) (2) Based on $4.74/kW
(3) Based on $12.42/MMBtu

2010 CONSTRUCTION PROJECT SCOPE

- Energy Efficiency Upgrade, Phase 1
  - 3 engineering firms/4 construction contracts:
    - Installed 23 VFD's to replace Eddy Current Clutches
    - Replaced 19 Motors with Premium Efficiency Motors
      - 25 h.p. to 125 h.p. units
    - WWTP Admin. Building EMS & HVAC Improvements
    - Pump Station HVAC Control System Improvements & installation of VFD and premium efficiency motor
    - Installed KW Meters to Track Energy Usage
    - Fine Bubble Aeration System Upgrade utilizing Motorized Air Valves
    - Upgraded Hot Water Condensate Pumps with VFD's
    - Replaced Plant Water Pumps and installed VFD's.

2010 CONSTRUCTION PROJECT SCOPE (continued):

- Energy Efficiency Upgrade, Phase 1
  - Installed New Energy Efficient Steam Boilers w/Dual Fuel Burners (Natural Gas & Digester Gas)
  - Lighting System Improvements
  - Installed 441 kW Photovoltaic Arrays.

2010 CONSTRUCTION PROJECT FUNDING

- Energy Efficiency Upgrade, Phase 1

  Four Construction Contracts prepared under a “fast-track” design schedule to allow projects to be “shovel ready” and eligible for DEP’s AARA funding grants.

  – ARRA Funding paid Construction Costs $4,922,384

  – Utility Incentives paid Design Fees $ 693,084

  – Net Cost to District $ 0

  – Simple Payback without funding 2.9 years

CONSTRUCTION PROJECT FUNDING 2000 - 2013

YEAR	PROJECT	CONSTRUCTION COST	UTILITY INCENTIVE	DEP FUNDING
2000	Biosolids Improvements, Contract 1	$17,580,759	NAF	$12,356,880
2000	Biosolids Heat Drying Facility	$12,169,501	NAF	$8,553,502
2003	Lighting System Upgrade - 2003	$139,213	$39,100	$0
2006	Secondary Syst Upgrade - Fine Bubble Diffusers	$19,162,497	$750,000	2% Loan
2010	Energy Project, Contract 1 - PEM & VFD's	$590,003	$315,046	DEP-ARRA
2010	Energy Project, Contract 2 - HVAC	$1,156,359	$137,285	DEP-ARRA
2010	Energy Project, Contract 3 - PW & VFD's	$531,400	$381,083	DEP-ARRA
2010	Energy Project, Contract 4 - Solar System	$1,976,172	$0	DEP-ARRA
2010	Lighting Upgrade, Phase 1	$99,613	$23,947	$0
2013	72" Force Main Replacement	$11,265,786	N/A	2% Loan
2013	Primary Clarifier Baffles & Aeration Upgrade	$2,136,712	$350,203	2% Loan
2013	Lighting System Upgrade, Phase 2	$118,399	$9,530	$0
	TOTALS	$66,926,414	$2,001,194	
				DEP GRANT
	Energy Projects Identified in 2009 Energy Audit			DEP 2% LOAN
			NAF = Not Applied For	

CONSTRUCTION PROJECT SAVINGS
2000 - 2013

YEAR	PROJECT	CONSTRUCTION COST	ANNUAL kWh/MMBTU SAVINGS	ANNUAL COST SAVINGS	PAYBACK (YRS)
2000	Biosolids Improvements, Contract 1	$17,580,759	-	↓	-
2000	Biosolids Heat Drying Facility	$12,169,501	-	$1,000,000	-
2003	Lighting System Upgrade	$139,213	382,848	$41,728	1.77
2006	Secondary Syst Upgrade - Fine Bubble Diffusers	$19,162,497	3,314,607	$287,376	1.52*
2010	Energy Project, Contract 1 - PEM & VFD's	$590,003	464,280	$65,309	0
2010	Energy Project, Contract 2 - HVAC	$1,156,359	62,196/6067 **	$83,600	0
2010	Energy Project, Contract 3 - PW & VFD's	$531,400	474,105/5497**	$135,010	0
2010	Energy Project, Contract 4 - Solar System	$1,976,172	-	$59,000+	0
2010	Lighting Upgrade, Phase 1	$99,613	260,225	$44,923	2.21
2013	72" Force Main Replacement (@165 mgd)	$11,265,786	1,402,800	$188,396	-
2013	Primary Clarifier Baffles & Aeration Upgrade	$2,136,712	1,298,501	$169,022	4.9
2013	Lighting System Upgrade, Phase 2	$53,497	101,379	$17,438	2.13
	TOTALS	$66,926,414	7,760,941/11,564	$2,091,802	
			* Based on $1,170,000 Cost	Savings based on $0.1343/kWh	
	Energy Projects Identified in 2009 Energy Audit		** kWh/MMBTU	Now: $0.08355/kWh	

D/B PHOTOVOLTAIC SYSTEM

	Capacity
• Area 1 & 2	
– Ground Mount System (bid in 2010)	
– kW Capacity:	441.0
– Number of PV Modules:	2100
Total D/B Bid Cost:	$1,971,742
Cost per Watt	$ 4.47

- In Comparison, ENR (8/19/2013)* indicates:
  - Installed PV Systems larger than 100 KW average $4.60 per watt
  - Utility-scale PV projects prices ranged from $2.30 to $6.80 per watt

* Data from Berkeley National Laboratory

PHOTOVOLTAC SOLAR SYSTEM

- The Solar System will save GLSD approximately $59,000 per year in Electricity Costs based on $0.106 per kW
- Solar Renewable Energy Certificates are available to GLSD to sell on the Open Market [2012 REC sale equaled $32,280]
- GLSD Solar Array generates enough electricity to power the equivalent of approximately 80 Massachusetts homes

FUTURE PROJECTS

- Pump Station – 2 New 800 h.p & 2 new 1250 h.p. Pumps & VFD's
  - Est. kWh Savings: 1,722,326
  - Est. Electric Cost Savings: $239,474
- Future CSO LTCP Projects and other project designs will always have energy savings initiates included
- EPA's Plan-Do-Check-Act system says always look to improve

CLEAN ENERGY FOR OUR KIDS FUTURE